

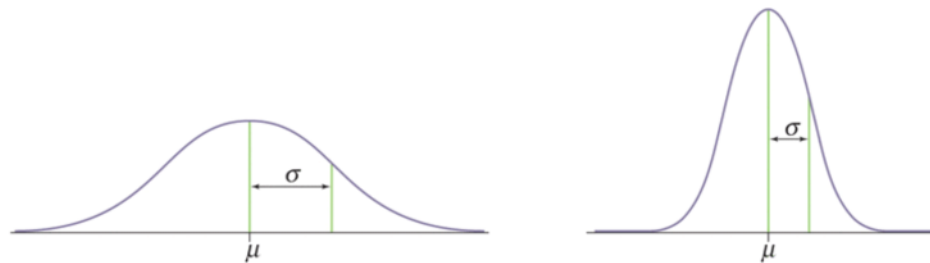
Wednesday, October 25, 2017  
12:02 PM

A **Normal curve** is an important type of density curve which describes a **normal distribution**.

Distributions that are often close to Normal include:

- Scores on tests taken by many people, such as **SAT exams and IQ tests**.
- Characteristics of biological populations such as **lengths of crickets and yields of corn**.

**Look at the two Normal curves below.** They illustrate several important facts:



☆ All Normal curves have the same overall shape: **symmetric, single-peaked, and bell-shaped**.

☆ Any specific Normal curve is completely described by giving its **mean  $\mu$**  (pronounced *mu*) and its **standard deviation  $\sigma$**  (*sigma*). So we can abbreviate with the notation  **$N(\mu, \sigma)$** .

☆ The **mean** is located at the **center** of the symmetric curve and is the **same as the median**.

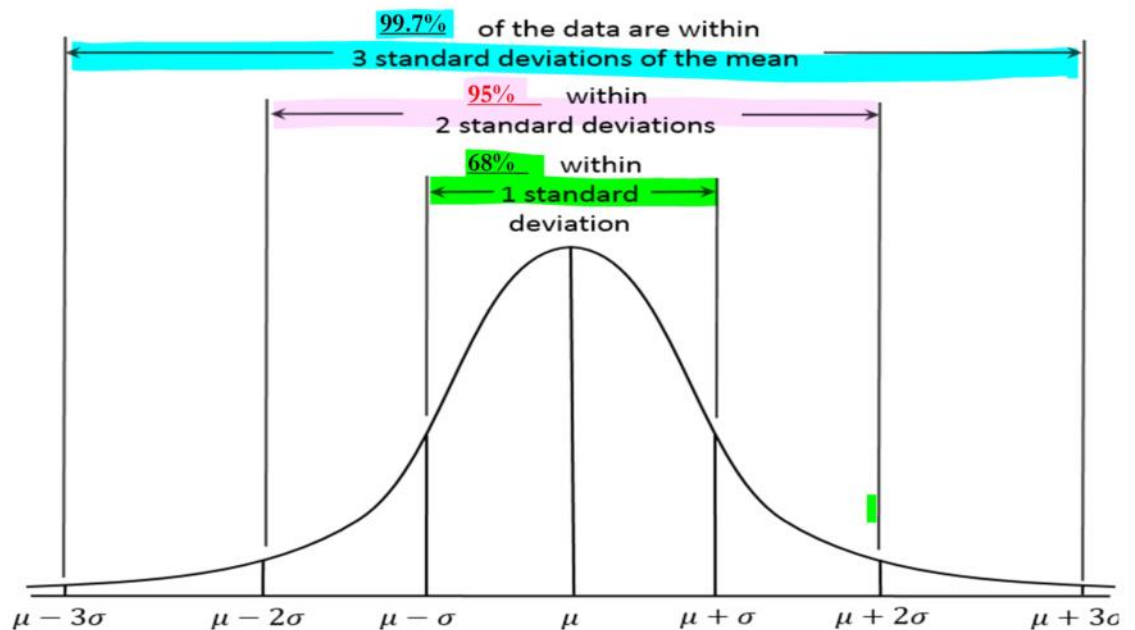
☆ Changing  $\mu$  without changing  $\sigma$  moves the Normal curve along the horizontal axis without changing its spread.

☆ The standard deviation  $\sigma$  controls the **spread** of a Normal curve, so curves **with larger standard deviations are more spread out**.

**A normal curve also has the following properties:**

- 1.) The total area under the curve is equal to **one**.
- 2.) The normal curve approaches, *but never touches*, the **x-axis** as it extends farther and farther away from the **mean**.
- 3.) Between  $\mu - \sigma$  and  $\mu + \sigma$  (in the center of the curve) the graph curves **downward**. The graph curves **upward** to the left of  $\mu - \sigma$  and to the right of  $\mu + \sigma$ . The points at which the curve changes from curving upward to curving downward are called **inflection points**.

**All Normal distributions obey the following rule:**



☆ This is known as the **Empirical Rule** or the **68–95–99.7 rule**.

Guided Practice:

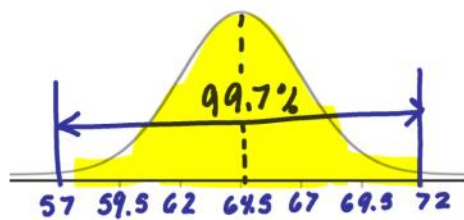
Use the Empirical Rule to answer the following.

**We must draw, shade & label a normal curve for EVERY problem!**

**Example:** Women's Heights

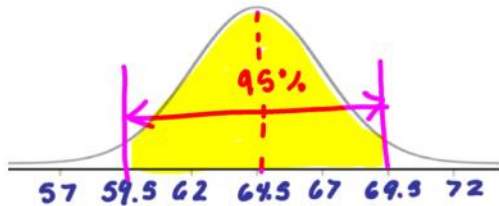
The distribution of heights of women aged 18 to 24 is approximately normal with a mean of 64.5 inches and a standard deviation of 2.5 inches.  $N(64.5, 2.5)$

a. What percent of women fall between 57 and 72 inches tall?



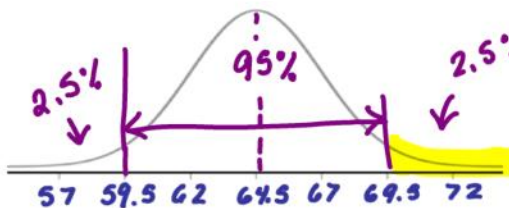
99.7%

b. Between what heights do the middle 95% of women fall?



59.5 and 69.5 inches

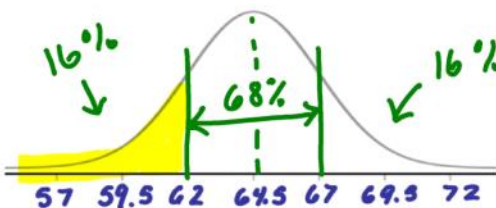
c. What percent of women are taller than 69.5 inches?



$$100 - 95 = 5$$
$$5 \div 2 = 2.5\%$$

2.5%

d. What percent of women are shorter than 62 inches?

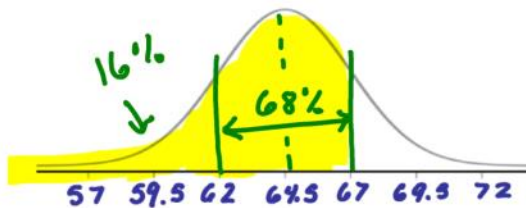


$$100 - 68\% = 32\%$$

$$32 \div 2 = 16\%$$

16%

e. A height of 67 inches corresponds to what percentile? \*Percentile means **area to the LEFT!**

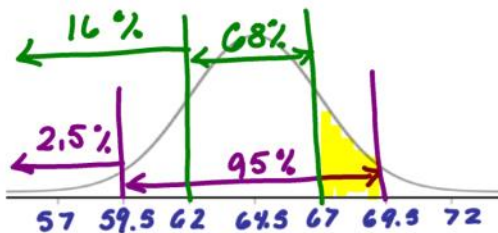


$$100 - 68 = 32$$

$$32 \div 2 = 16$$

$$16 + 68 = \boxed{84^{\text{th}} \text{ percentile}}$$

f. What percent of women are between 67 and 69.5 inches tall?



$$95 + 2.5 = 97.5 \%$$

$$68 + 16 = 84 \%$$

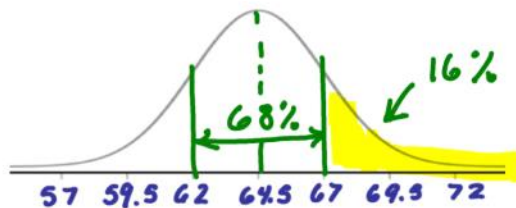
$$97.5 \% - 84 \% = \boxed{13.5 \%}$$

Partner Practice: Draw, shade & label a normal curve for EVERY problem!

1) Women's Heights

The distribution of heights of women aged 18 to 24 is approximately normal with a mean of 64.5 inches and a standard deviation of 2.5 inches.  $N(64.5, 2.5)$

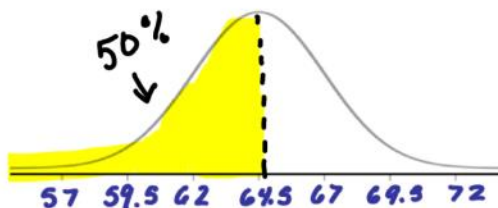
a. What percent of women are taller than 67 inches?



$$100 - 68 = 32$$

$$32 \div 2 = \boxed{16 \%}$$

b. A height of 64.5 inches corresponds to what percentile?

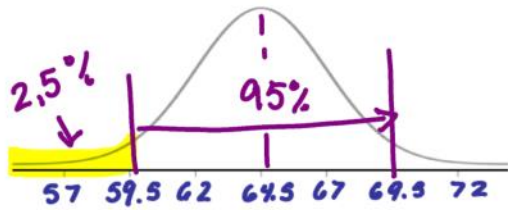


$\boxed{50^{\text{th}} \text{ percentile}}$

Explain what this means.

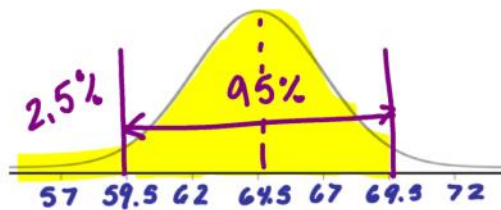
A women that is 64.5" tall is taller than 50% of all women.

c. A height of 59.5 inches corresponds to what percentile?



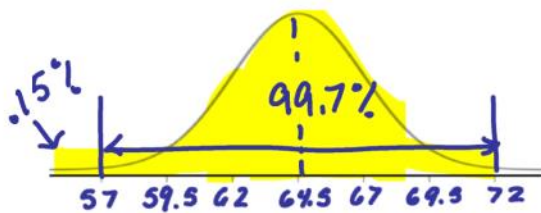
2.5<sup>th</sup> percentile

d. A height of 69.5 inches corresponds to what percentile?



$95 + 2.5 = 97.5^{\text{th}}$  percentile

e. A height of 72 inches corresponds to what percentile?

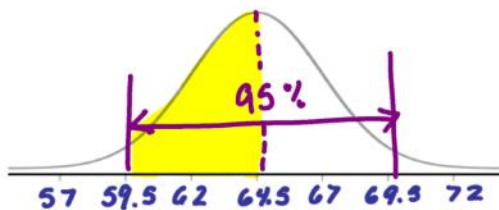


$$100 - 99.7 = 0.3$$

$$.3 \div 2 = .15 \%$$

$99.7 + .15 \% = 99.85^{\text{th}}$  Percentile

f. What percent of women are between 59.5 and 64.5 inches tall?



47.5 %